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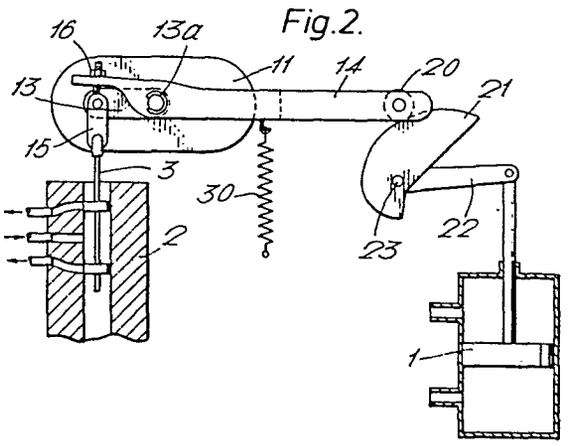
(54) **Improvements in or relating to positioners.**

(57) The invention provides a positioner by which a member (1), which may be massive and, for instance, a part of a valve, may be moved to a pre-determined position. The movement of the member (1) is controlled by a pneumatic valve (2) that is connected to a lever (14). The lever (14) is pivoted at two locations (13*a* and 20) which can both be moved transversely to the lever (14). By moving the first location (13*a*) the pneumatic valve (2) is open to move the member (1) and movement of the member (1) moves the second location (20) to tilt the lever 14 back to a position in which the pneumatic valve (2) is again closed.

Fig.2.



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"Improvements in or relating to Positioners"

DESCRIPTION

This invention is concerned with the control of the movement of a mumber that may itself be the control element of a valve and arose from a consideration of the problems involved in controlling the movement of massive components by devices that themselves can exert only small forces. Thus, the member might be the control element of a large valve, and it might be desirable to control the movement of that element by a pneumatic valve that itself is adjusted by means, such as a stepping or pulsing motor, that can exert only a small but precise force.

According to the present invention, in apparatus in which movement of a member is initiated by the energization of a drive unit and is progressive whilst the unit is energized, means for controlling the extent of the movement of the member including a lever pivoted at two locations that are spaced apart, actuating means by which each pivot location can be moved to-and-fro in a direction transverse to the direction in which the pivot locations are spaced apart, a controlling connection between the unit and the lever that is associated with the lever at a location that, in said direction, is spaced apart from each of the pivot locations, one of the actuating means including a crank arm pivotally connected to

the lever at one pivot location and the other including a connection to the member such that the position of the other pivot location is dependent upon the position of the member, the arrangement being such that the unit is not energized when the location at which the unit is connected to the lever is co-incident with the axis about which the crank arm turns, with the lever in a base position in which that co-incidence occurs, rotation of the crank arm then to a rest position moves the lever about the other pivot location so that the co-incidence no longer exists and the unit is energized, and movement of the member effects movement of the lever from that position to a closing position in which the co-incidence occurs again so that the unit is again not energized, there also being provided means by which the lever may be restored to its base position and the position of the crank and the member are returned to the positions that they occupied when the lever was in its base position.

Also, according to the present invention, in apparatus in which movement of a member is initiated by the energization of a drive unit and is progressive whilst the unit is energized, means for controlling the extent of the movement of the member including a lever pivoted at two locations that are spaced apart, actuating means by which each pivot location can be moved to-and-fro in a direction transverse to the direction in which the pivot locations are spaced apart, a controlling connection between the unit and

the lever that is associated with the lever at a location that, in said direction, is spaced apart from each of the pivot locations, one of the actuating means including a crank arm pivotally connected to the lever at one pivot location and the other including a connection to the member such that the position of the other pivot location is dependent upon the position of the member, the arrangement being such that the unit is not energized when the location at which the unit is connected to the lever is co-incident with the axis about which the crank arm turns, with the lever in a base position in which that co-incidence occurs, rotation of the crank arm then to a rest position moves the lever about the other pivot location so that the co-incidence no longer exists and the unit is energized, and movement of the member effects movement of the lever from that position to a closing position in which the co-incidence occurs again so that the unit is again not energized, the arrangement also being such that, with the lever in the closing position rotation of the crank arm in the reverse sense to a second rest position moves the lever about the other pivot location so that co-incidence no longer exists and the unit is energized so as to effect movement of the member in the reverse sense, and the movement of the member effects movement of the lever from that position to a further closing position in which the co-incidence occurs again so that the unit is again not energized.

By way of example, an embodiment of the invention will now be described with reference to the accompanying drawing which shows, somewhat schematically, positioner, with Figure 1 being a plan view and Figure 2 being a side view.

In the particular embodiment that is illustrated, the member of which the position is to be controlled is the valve piston 1, movement of which is effected pneumatically through the double acting pilotrol, or balanced spool, valve 2. In the condition in which it is shown, the valve 2 prevents operation of the valve piston 1. By moving the stem 3 of the valve 2 upwardly, the valve piston 1 moves upwardly; reverse movement of the stem 3 moves the valve piston 1 downwardly. To move the stem 3, the stepper motor 10, acting through the gear box 11, is used.

Fixed to the output spindle 12 of the gear box 11 is a crank arm 13 that is pivotally connected on spindle 13a, at some distance from the spindle 12, to a lever 14. The connection 13a is spaced from the end of the lever 14 and there is a controlling connection between that end and the stem 3. The connection includes a link 15 pivotally connected at its lower end to the stem 3 and at its upper end to the lever 14 through a nut-and-rod connector 16 that, in operation, is fixed but is adjustable in setting up the apparatus to allow the position of the connection to the upper end of the link 15 to be varied.

At the end remote from the connector 16, the lever 14 carries a roller 20 that acts as a cam follower. The edge of plate 21 acts as the cam surface and the plate is fixed to an arm 22 that is pivotally connected to the stem 1a of the valve piston 1. The stem 1a turns about a fixed pivot 23 as the stem 1a moves, so that the plate 21 also turns about that pivot and moves the lever 14 through the engagement of the cam follower 20 with the plate 21. The cam surface is not a circle centred on the pivot 23 but resembles more a part of an ellipse with the pivot 23 as one of its centres. By means not indicated, the plate 21 is fixed to the arm 22 in such a way that their relative orientation can be adjusted so that the movement of the cam follower 20 resulting from a particular movement of the stem 1a can be varied.

A spring 30 is provided to ensure engagement of the cam follower 20 with the cam surface.

Now suppose the apparatus is in a base, or rest, or equilibrum, position as shown and it is desired to raise the valve piston 1. In this base position, the connection at the upper end of the link 15 to the lever 14 is co-incident with the spindle 12 and the valve 2 is closed.

The motor 10 is now operated and this will turn the crank arm 13 in an anti-clockwise direction to a rest position; the extent of the rotation will determine the movement of the valve piston 1.

Rotation of the crank arm 13 will pivot the lever about the cam follower 20, so raising the valve stem 3 and permitting the passage of fluid that will move the valve piston 1. Movement of the valve piston 1 will turn the plate 21 in the sense that raises the cam follower 20. The consequent lifting of the lever 14 about the pivot represented by the spindle 13a will lower the link 15 until the lever attains a closing position in which the connection between the link 15 and lever 14 is again co-incident with the spindle 12 and the valve 2 is again closed. Closure of the valve 2 prevents further movement of the valve piston 1. Thus, although the forces exerted by the motor 10 are small and the valve piston 1 may represent a massive member, the latter can be precisely positioned to the control of the former.

By rotating the crank arm 13 in the reverse sense, the valve piston 1 can be moved in the opposite sense. This will rotate the plate 21 appropriately and the roller 20 will be kept in contact with the plate 21 by the spring 30. Consequently, the lever 14 will achieve a second closing position in which the connection between the stem 3 and the lever 14 is co-incident with the spindle 12. This closing position, too, is determined by the extent to which the crank arm 13 is rotated and this, too, is controlled in accordance with the extent to which the piston valve is intended to move. In some modes of operation, the base position

may be the median between a first and a second closing position.

In the embodiment that has been described, the axis of the spindle 12a, the contact between the cam follower 20 and the plate 21, and the point of connection between the spindle 3 and the lever 14 are co-linear. The to-and-fro movements, in operation, of the spindle 13a and the cam follower 20 transverse to this line are virtually perpendicular to the line.

In other embodiments of the invention, the pneumatic valve 2 might be replaced by an electrical switch device which maintains energized means by which the valve piston 1 is moved until that member reaches its final position.

CLAIMS

1. In apparatus in which movement of a member is initiated by the energization of a drive unit and is progressive whilst the unit is energized, means for controlling the extent of the movement of the member including a lever pivoted at two locations that are spaced apart, actuating means by which each pivot location can be moved to-and-fro in a direction transverse to the direction in which the pivot locations are spaced apart, a controlling connection between the unit and the lever that is associated with the lever at a location that, in said direction, is spaced apart from each of the pivot locations, one of the actuating means including a crank arm pivotally connected to the lever at one pivot location and the other including a connection to the member such that the position of the other pivot location is dependent upon the position of the member, the arrangement being such that the unit is not energized when the location at which the unit is connected to the lever is co-incident with the axis about which the crank arm turns, with the lever in a base position in which that co-incidence occurs, rotation of the crank arm then to a rest position moves the lever about the other pivot location so that the co-incidence no longer exists and the unit is energized, and movement of the member effects movement of the lever from that position to a clos-

ing position in which the co-incidence occurs again so that the unit is again not energized, there also being provided means by which the lever may be restored to its base position and the position of the crank and the member are returned to the positions that they occupied when the lever was in its base position.

2. In apparatus in which movement of a member is initiated by the energization of a drive unit and is progressive whilst the unit is energized, means for controlling the extent of the movement of the member including a lever pivoted at two locations that are spaced apart, actuating means by which each pivot location can be moved to-and-fro in a direction transverse to the direction in which the pivot locations are spaced apart, a controlling connection between the unit and the lever that is associated with the lever at a location that, in said direction, is spaced apart from each of the pivot locations, one of the actuating means including a crank arm pivotally connected to the lever at one pivot location and the other including a connection to the member such that the position of the other pivot location is dependent upon the position of the member, the arrangement being such that the unit is not energized when the location at which the unit is connected to the lever is co-incident with the axis about which the crank arm turns, with the lever in a base position in which that co-incidence occurs, rotation of the crank arm

then to a rest position moves the lever about the other pivot location so that the co-incidence no longer exists and the unit is energized, and movement of the member effects movement of the lever from that position to a closing position in which the co-incidence occurs again so that the unit is again not energized, the arrangement also being such that, with the lever in the closing position, rotation of the crank arm in thereverse sense to a second rest position moves the lever about the other pivot location so that co-incidence no longer exists and the unit is energized so as to effect movement of the member in the reverse sense, and the movement of the member effects movement of the lever from that position to a further closing position in which the co-incidence occurs again so that the unit is again not energized.

3. What is claimed in claim 2 and being such that rotation of the crank arm in the reverse sense through an angle equal to its rotation in the direct sense serves torestore the lever to its base position.

4. What is claimed in any of the preceding claims in which the three locations are all in a straight line.

5. What is claimed in any of the preceding claims in which in the actuating means that includes a connection to the member, the connection is adjustable so that the distance moved by the member before co-incidence again occurs.

6. What is claimed in any of the preceding claims in which in the actuating means that includes a connection to the member, the connection includes a cam that is rotated by, and to an extent that is determined by, movement of the member, and the pivot of which the location is determined by the actuating means is formed by a follower that co-operates with the cam.

7. What is claimed in claim 6 in which the follower is a roller and spring means is provided to ensure that the follower retains contact with the cam.

8. What is claimed in either of claims 6 and 7 when appendant to claim 5 in which the cam is connected to the member in such a way that the part of the cam surface with which the follower co-operates can be altered to alter the distance moved by the member before co-incidence again occurs.

9. What is claimed in any of the preceding claims in which the position of the crank arm is determined by a stepping or pulsing electric motor.

10. What is claimed in any of the preceding claims in which the drive unit is a pneumatic valve that, when energized, permits the passage of pneumatic fluid.

Fig.1.

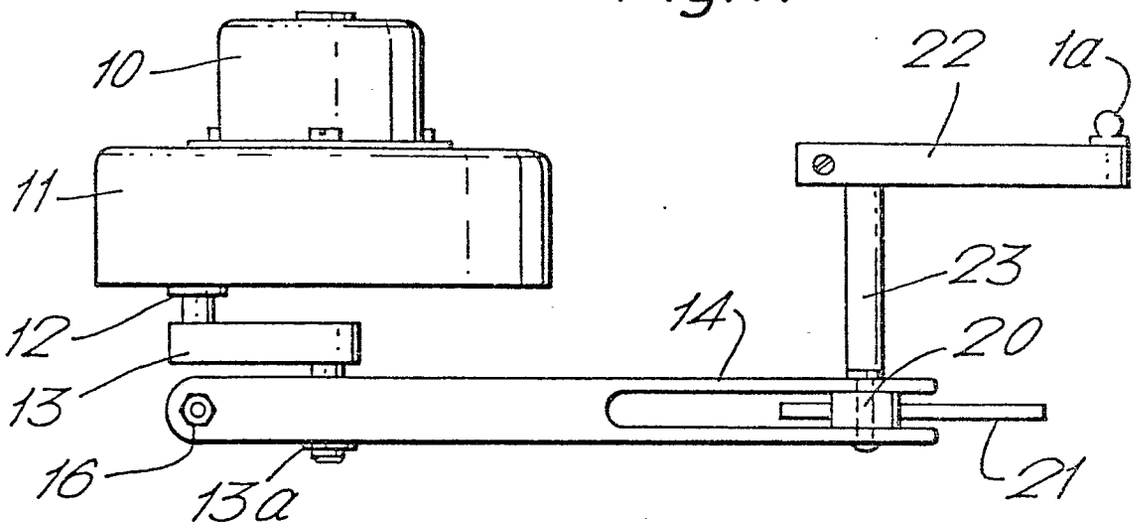
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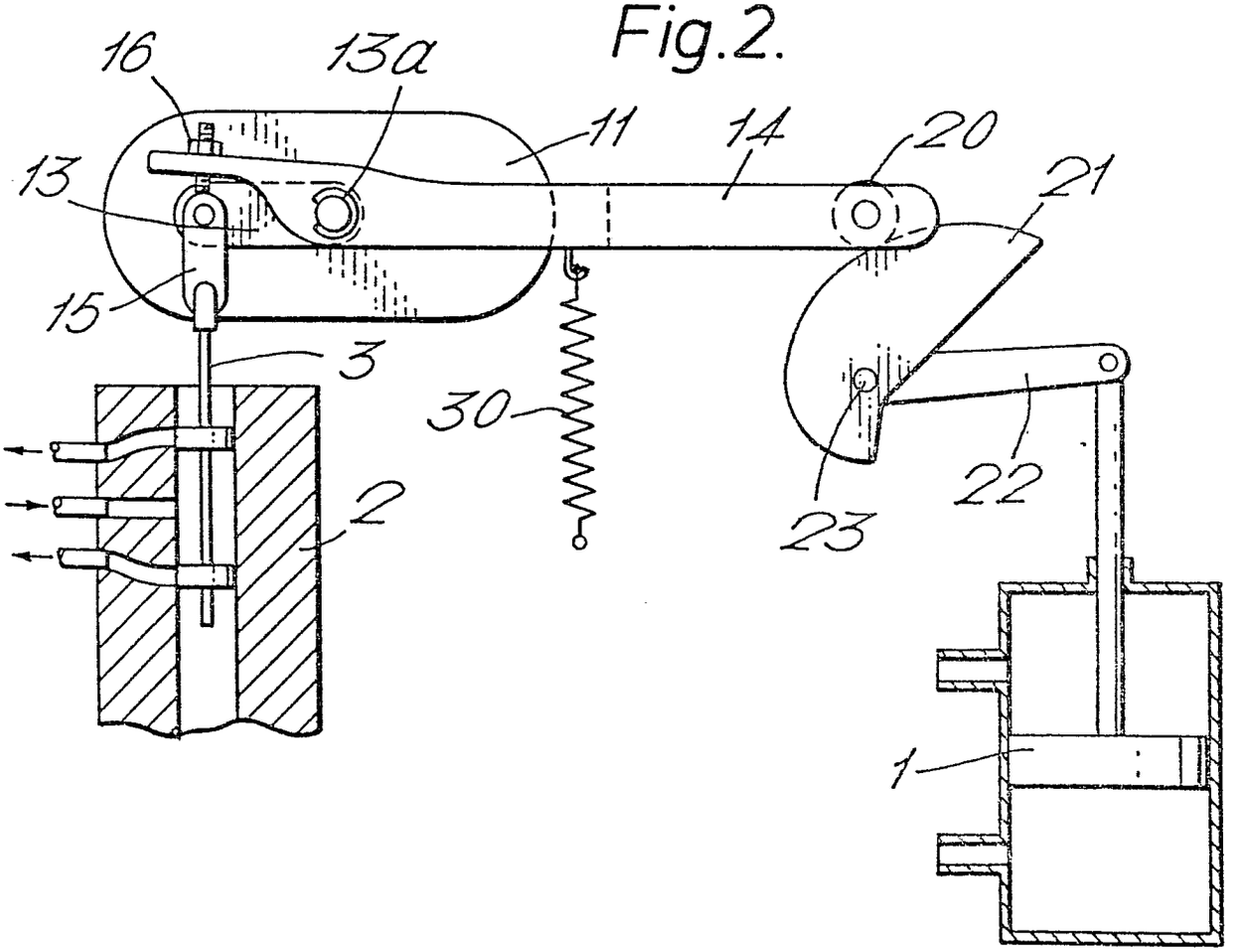
Fig.2.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